Manual 831 E

MONARK
SPORTS & MEDICAL

Important

Read the manual carefully before using the cycle and save it for future use.

Contents

Monark Exercise AB

Monark has 100 years' experience of bicycle production. The Monark tradition has yielded know-how, experience, and a real feel for the product and quality. Since the early 1900s, Monark's cycles have been living proof of precision, reliability, strength and service. These are the reasons why we are now the world leader in cycle ergometers and the market leader in Scandinavia in transport cycles.

We manufacture, develop and market ergometers, exercise bikes, transport bikes and specialized bicycles. Our largest customer groups are within health care, sports medicine, public authorities, industry and postal services.

For more information: www.monarkexercise.se

Product Information

Congratulations on your new Ergometer.

The Monark Ergomedic 831 E is a stable armergometer that qualify for the fitness tests and work samples with the upper body. Speed-independent and easy to control from external devices such as PCs and ECG make it user friendly and safe. Monark's pendulum weight system is designed for use in rehabilitation, sports medicine and medicine. Works great for training from a wheelchair.

The ergometer is controlled by either a terminal, an external PC or other external units. The ergometer can perform max and submax fitness tests and calculate the VO_2 max. The ergometer can be connected to ECG device to do work tests.

It is possible to build personal programs that are custom made for the user. The ergometer can also be used for manual training.

NOTE!
Use of the product may involve considerable physical stress. It is therefore recommended people who are not accustomed to cardio or do not feel completely healthy to consult a physician for advice before use.

Serial number

The serial number of your ergometer is placed according to *fig: Serial number.*

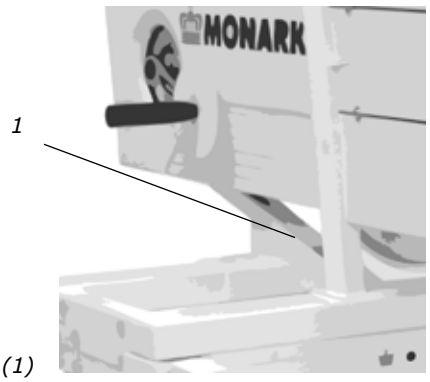


Fig: Serial number (1)

Facts

- Ready for digital control via ECG or PC by RS232 cable
- Well-balanced flywheel, 12 kg
- Pendulum scale, easy to calibrate
- RPM-independent
- Brake power 0-1400W (depending on rpm)
- Corrosion protected and powder coated
- Wheels for easy transport
- Display to show RPM
- Pulse monitor online with chestbelt, telemetry
- Optical metronome that shows handle stroke or heart rate
- Warning signal for maximum heart rate limit

Computer
- Computer system 8 MHz
- Multi-colour rpm pacing bar graph display
- Visual metronome or heart rate
- Serial communication port: 300-38400 baud
- HR-training

Width
700 mm (28")

Length
1500 mm (59")

Height
1160 mm (46")

Weight
79 kg (174.2 lbs)

Included
Chestbelt, PC software, calibration weight, tool kit, power adaptor.

Technical data power adaptor
Input voltage: 110-240V AC, 50/60Hz.
Current: 650mA
Output voltage: 24V DC switching adaptor alt. 18V AC.
(Sweden, 18V, Art. No: 9339-67, other countries incl. USA, 24V, Art. No: 9339-66).

Note: The power adaptor must be approved by your national electrical authorities. In Europe: it must be CE marked.

Operating Instruction

Here are instructions for connections and opportunities for connection to external communication. The need for advanced technical documentation/protocols for systems building, contact Monark Exercise AB, Sweden.

Power on crank or flywheel

When the Ergometer 831 E is adapted to ECG-work tests, it is set to measure the power on the crank.

When the Ergometer 831 E is adapted to fitness tests, it is set to measure the power on the flywheel.

Operation of the ergometer

The Ergomedic 831 E is built on a stabile frame, a well-balanced flywheel, a break belt and a pendulum weight which measures the force. Handles and a chain drive are provided to spin the flywheel as a tension device tightens the belt to regulate the braking force applied to the wheel. The pendulum indicates the applied force directly on the scale located on the right side of the flywheel.

The computer system consists of one main unit and one control unit (terminal, PC or ECG). The main unit reads in the crank handle speed, the applied force and determines the subjects heart rate by a chestbelt transmitter. Additionally, the base control activates the motor to adjust the tension of the belt, thereby regulating the applied braking force. The force may be automatically varied in response to changes in crank handle speed to maintain a constant power workload.

For information about how respective control unit works, see section ”Connection to controller”.

The Monark Ergometer 831 E can be controlled externally from a terminal, a computer or an ECG device. A printer can also be connected to the ergometer.

The control is performed over a serial line using ANSI/ ISO/ASCII format commands. The interface is a 9-pin male D-sub connector, compatible with the RS232 standard, located on the front of the electronic box. To connect to a PC use a 0-modem serial cable with 9-pin female connectors in both ends.

It is also possible to use an analogue control from an external source to set the workload. This is done by the contacts b32 and z32 on the main connector on the bike.

The ergometer need not be turned off prior to connection of the external components, although removing the power from all devices may prevent erroneous data transfer between equipment during interconnection. Caution must be exercised in the connection of various types of equipment from different manufactures to avoid electrical hazards and physical damage. The user must be certain that the instrument connector and the cable are designed for the intended purpose. Serious injury to the user and/ or equipment may result if inappropriate connections are attempted.

Measured quantities

Distance	meter, Miles
Energy	kcal
Heart rate	beats/minute (bpm)
Force	Newton (N), kp
Power	Watts (W), kpm/min or VO_2 ml/min/kg
Time	min:sec
Weight	kilogram (kg), pounds (lb)

RPM Display and Visual Metronome/Pulse

The metronome (the two green LED bars in the middle) flashes once per handle stroke at a preset rate. The two green LED bars in the middle can also be set to show pulse. It makes one flash for every heart beat. Crank handle frequency compared to metronome rate is always shown.

Underspeed:
Crank handle speed is lower than desired metronome rate. 2, 4, 8, 16 or more depending on which LED bar that indicates.

Overspeed:
Crank handle speed is greater than desired metronome rate. 2, 4, 8, 16 or more depending on which LED bar that indicates.

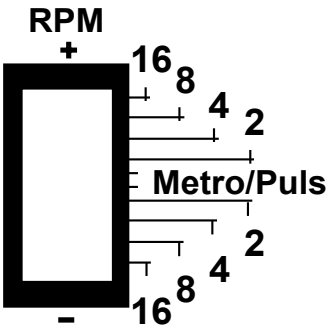


Fig: Rpm display

Initial operation

Although all 831 E ergometers are 100 % calibrated at the factory, the user may wish to verify this by performing the mechanical calibration of the pendulum weight. See section ”Calibration of Pendulum Weight”.

Apply power to the ergometer by first connecting the cable from the power adaptor to the ergometer at the front connector labelled “24VAC/18VAC“. Then plug the power adaptor into the wall outlet. Turn the power switch to “On”-position. A green LED indicates power to the 831 E.

Perform the electrical calibration as specified in section ”Electronic calibration”.

Test run the ergometer. The Ergometer 831 E is now fully functional and ready to use.

Height adjustment of table stand

The height of the table stand can be adjusted to get the ergometer at the desired level by using the crank at the stand. To adjust the height on the table stand, pull out the crank and crank it until the desired height is reached. To lock the table stand, push the crank again. See *fig: Table stand*.

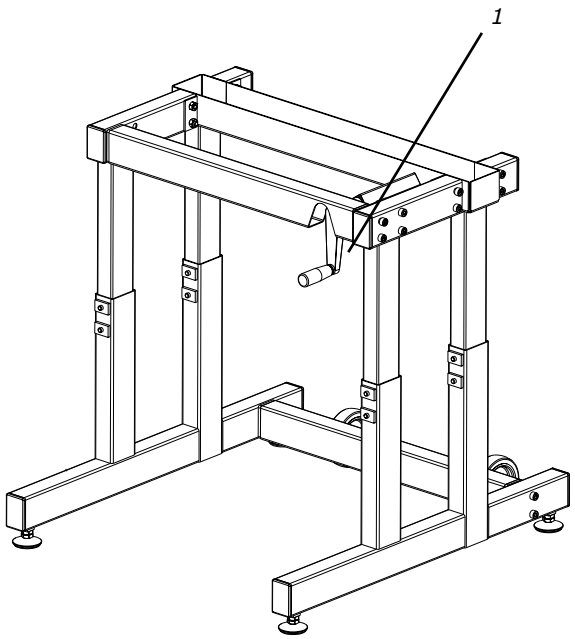


Fig: Table stand
Height adjustable crank (1)

Connection to controller

Setting of commando type (PC or ECG Device)

From programme version R15

First check the brake belt tension. If the belt is too tight loosen it a little by moving the pendulum to about 4 kp and hold it there for a few seconds. Then the force-adjusting servo will loosen the belt tension. To be sure that pendulum positions are correct, do a calibration. See "Electronic calibration".

1. Press the switch to turn off the power, see *Fig: Connections*. Disconnect the cable from any connected device.
2. Adjust the scale mechanically so that 0-index on the scale and the mark on the pendulum are in line.
3. Move the pendulum to 6 kp and hold it there.
4. Turn on the power again. The green LED (3) lights when power is connected to the bike.
5. Hold the pendulum at 6 kp until two beeps are heard.
6. Move the pendulum to:
   0 = mode for use with PC or terminal.
   1 = mode for Siemens Megacart ECG.
   2 = mode for other ECG devices, alt 1.
   3 = mode for other ECG devices, alt 2.
7. Hold the selected position until two beeps are heard. Then release the indicatior to 0. The system will now restart in the seleted mode.

Alt. 1: ECG, Ergoline compatible command set, requested load value.
Alt. 2: ECG, Ergoline compatible command set, current load value.

What command type is set?

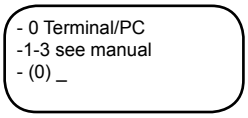
When the power is turned on a beep is heard and depending on the beeps number you can decide which command type is set.

- Commando type 0: One long beep.
- Commando type 1: A long beep followed by a short beep.
- Commando type 2: A long beep followed by two short beeps.
- Commando type 3: A long beep followed by three short beeps.

Setting of terminal

When using a terminal (Art. No: 9339-51) do as follows:

1. Connect the terminal to the ergometer using the enclosed cable.
2. Connect power to the ergometer.
3. When the main menu is displayed on the LCD-screen press '99' and the hidden service menu appears.
4. Press '6', "Settings".
5. Press 'ENTER' (normally 13 times) until the display "Command type" appears.



   a) Press '1' and 'ENTER' if the ergometer is connected to a Siemens Megacart ECG device.
   b) Press '2' and 'ENTER' if the ergometer is connected to other ECG device with an Ergoline protocol for communication, alt 1.
   c) Press '3' and 'ENTER' if the ergometer is connected to other ECG device with an Ergoline protocol for communication, alt 2.
   d) Press '0' if the ergometer is connected to a terminal or PC.

6. After that press '0' twice to go back to main menu.

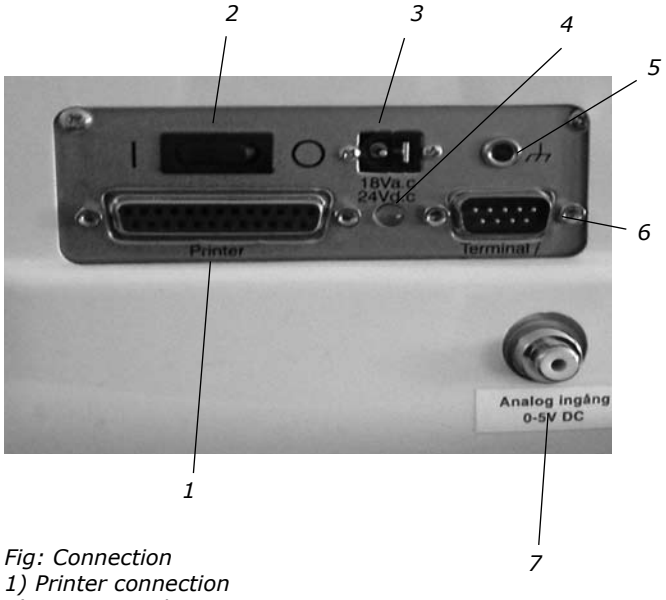


Fig: Connection
1) Printer connection
2) Power switch
3) Power connection
4) LED
5) Chassis ground
6) Terminal/PC (serial)
7) Analogue connection

Connection to PC

To connect a PC to the ergometer, use a 0-modem cable (RS232) with a 9-pin D-sub female at each end. If no RS232 Serial port is available on the computer use a USB serial RS232 converter.

To control the ergometer use the PC software supplied with the ergometer or other PC software made for the Ergomedic 831 E.

From software version MEC3V11R14 and later settings can be made from a PC in terminal mode if the terminal is not available. Set PC in terminal mode. A terminal emulator is normally available in i.e. Windows under Accessories/Communication.

If no RS232 serial port is available on the PC use a USB serial converter to connect to an USB port.

In terminal mode do the following settings:

- 9600 baud
- 8 data bit
- 1 stop bit
- no parity
- no flow control
- set terminal emulation to VT100
- set the COM port number. A USB serial converter is automatically assigned to a COM port number by Windows. This number is indicated under Startmenu / Settings / Control Panel / System Hardware / Device Manager. The USB serial adaptor should be listed in the Ports (COM & LPT) section.

Connect Ergometer and PC with the 0-modem cable (normally used for the ergometer terminal).

Turn on power to the ergometer. The ergometer is now checking what type of device is connected. When finished a message appears on the PC screen.

Common commands:

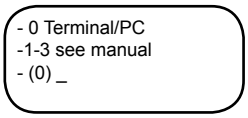
- Calibration: Type: cali[enter] and follow the instructions on the screen.
- Setting to control ergometer from an external Siemens Megacart ECG device: Type: env cmdtype=1[enter]
- Setting to control ergometer from other external ECG devices: (most common setting) type: env cmdtype=2[enter]

To go back to control the ergometer with the terminal. Type: env cmdtype=[enter] or env cmdtype=0[enter]

A lot of other settings can be made. For more information about this, please see Technical Reference Manual MEC3V11Rn.

Connection to an external ECG device, digitally controlled

1. Connect the terminal to the main unit on the front of the bike (use the 0-modem cable with a 9-pin D-sub female at each end).
2. Connect the net adaptor to a suitable wall outlet and to the Monark Ergometer 831 E and then turn power on.
3. After a short while the main menu is shown on the handheld display.
4. Press ’99’ and the service menu comes up on the display.
5. Press ’6’ for Service set-up.
6. Press ‘ENTER’ on the following settings until “Command Type” is shown.
7. This says:



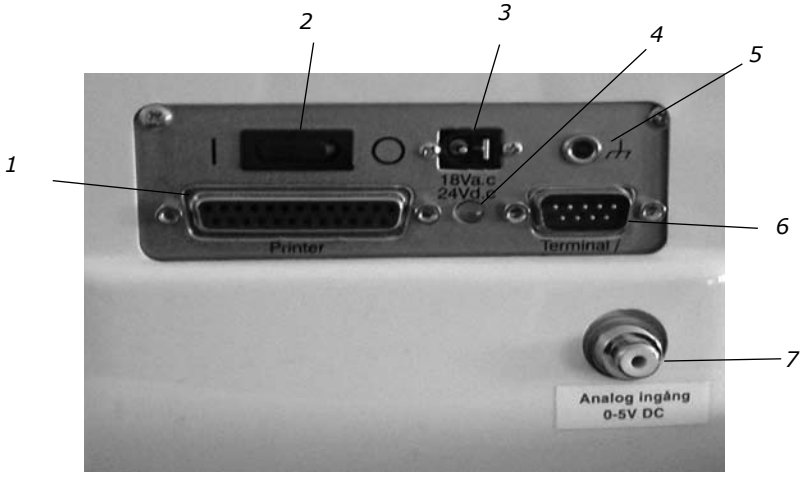
If a zero (0) is displayed at the 3rd line, the bicycle is in normal mode which means that the bike can not be controlled by an external ECG device. Press ’1’ if a Siemens Megacart with Ergomed 940 will be used. For use of other devices press ’2’ or ’3’ and then ‘ENTER’. If correct figure is displayed from the beginning just press ‘ENTER’.

8. Return to main menu by pressing ’0’ and press ’0’ again to finish. The computer will then save the settings in the memory before it turns off. Computer will start up again automatically after a few seconds.
9. Turn off the power and remove the terminal.
10. Connect the cable (Megacart needs a specific cable) into the ECG device.’
11. The Ergometer can now be controlled only from an external ECG device.

Reset the Ergometer to use with terminal/PC.

Follow steps 1–7. At step 7 press ’0’ and then ‘ENTER’. The Ergometer can now be controlled again from the terminal or an external PC.

Fig: Connections
1) Printer connection (parallel)
2) Power switch
3) Power connection
4) LED
5) Chassis ground
6) Terminal/PC (serial)
7) Analog connection



Analogue control

The work load of the Ergometer can be controlled by external devices such as an analogue ECG device (must be between 2 and 4 volts to operate properly). For settings, see the manual for the terminal and manual for the software.

Printer

The 831 E Ergometer interfaces to several optional devices. A parallel interfaced printer may be attached to provide written reports.

The terminal or the computer attaches both via a serial cable to the 9-pin interface connector located on the front of the ergometer. Attach a printer if available to the parallel port on the front.

If the instrument is a terminal or printer, the system may need to be set-up. Verify that the System set-up have been set to enable automatic printout. If it has been disabled, no output will reach the device until it has been enabled. Also, the baud rate selected by the interface cable must match that of the device. If the device is a printer, proper paper loading and unit selection must be completed prior to operation (refer to printer instruction manual).

The automatic printout length is a preset to eleven inch pages for standard fanfold or zee-fold paper. At the top of the each page, a header designating the columns is printed.

The time period between the printing of each line may be set as desired, from 0 (continuous output) to 255 seconds in one second increments. The standard setting is 15 seconds between printouts. This provides reasonable documentation while not wasting large quantities of paper.

Calibration

The 831 E is a mechanically weighted and braked ergometer, making performance validation a simple procedure. Calibration is necessary to match the mechanics of the ergometer to the electronics of the computer. The work performed on the ergometer is the product of the weight lifted times the numbers of revolutions (factored). Validation includes both mechanical and electronic procedures. For more information, see Manual terminal (art. No: 7950-302) or the manual of the software. If the ergometer fails to pass any section of the validation, proceed to the calibration and/or service menu ('99' in the main menu).

Inspection of all mechanical components is suggested after any repair, or component service. The following validation should be performed annually:

1. Remove the cover from the flywheel.
2. Loosen the brake belt at the balancing spring.
3. Wait until the flywheel is no longer moving.
4. The pendulum weight index should be aligned with "0" on the scale.
5. Attach the calibration weight where the balancing spring was placed, see fig: Calibration weight
6. The known weight should match the value on the scale. If not see section "Calibration of Pendulum Weight ".
7. Reattach the tension belt.
8. Reassemble the cover.

Proceed to the "Daily check" to complete, which is also included in the yearly check.

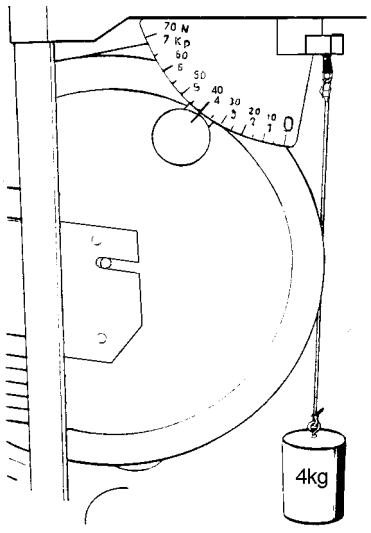


Fig: Calibration weight

Daily check

The following procedure will assure the user that the ergometer is performing properly on a daily basis.

- Checking the pulse function, see section.
- Control of work load, see section.
- Crank handles around and check that it obtained a reasonable rpm - check the clock.
- Check that the handles are moving smooth and nice. Listen for any noise - fix if necessary.
- Check that the table's height adjustable feature works.
- Make sure the ergometer and table are stuck together and that the table is stable. Tighten the screws if necessary.

If you found something strange at the daily check that you cannot fix by your own, please contact the service at Monark Exercise.

Checking of the pulse function

While a patient is at rest and has been prepared for chest belt electrodes or an ear sensor, the pulse indicator flashes once per pulse beat. The displayed heart rate, should agree with the manually detected pulse rate. If not, check the patient electrode connection and skin preparation prior to requesting service. If not, check the patient electrode connection and skin preparation prior to requesting service.

Validation of force

From main menu go to any start display with Newtons (N). See *Fig: Force*.

1. With the pendulum at zero, the display should read “00N“.
2. Move the pendulum weight to the 4 kp position and the display should read “39N“.

If the workload is not displayed properly, a calibration must be done. See ”Electronic calibration”.

NB:
The brake belt will become loose and because of this it will take a few seconds before normal workload is obtained the first time the ergometer is used.

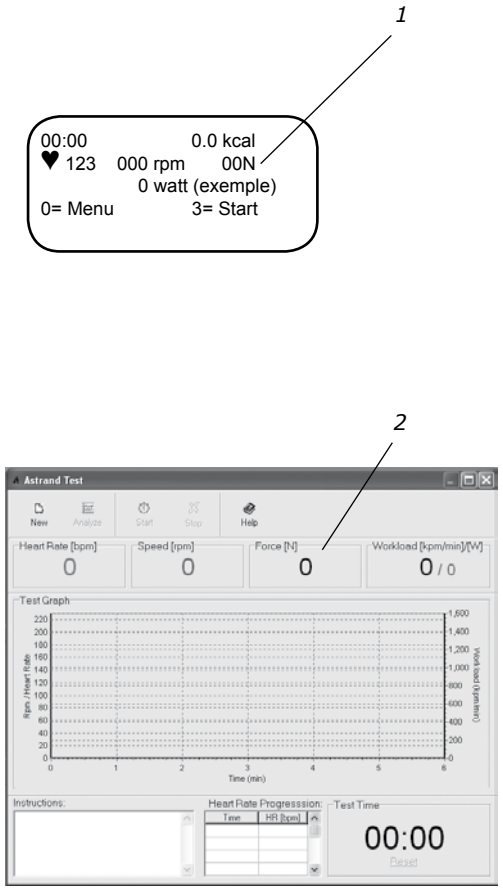


Fig: Force
1 Force in the display of the terminal
2 Force in the software

Electronic calibration

A daily check of the pendulum force sensor should be preformed. If the procedure reveals an error, recalibration may be necessary. The values are saved even if you turn off the power and if you physically move the bike. Usually it is not necessary to recalibrate the bike, but it should be done after each service, change of electronical parts, moving or after you have programmed into "Recovery" by default. (Terminal alt. ‘99’, in the main menu and then alt. ‘3’ in the service menu).

The following steps show how the electronics are calibrated against the pendulum scale.

The calibration coefficient which has been calculated by the computer is stored in the continuous memory. Whenever power is applied to the ergometer, the latest calibration value is restored to maintain memory. A new calibration replaces previous values.

A check of the electronic calibration can be done in the computer program. Choose a test. In the dialogue box that shows, you can read "Force [N]". If terminal is used, chose a test. You can see the work load at the "N" in the display. See *Fig: Force*.

NB:
The brake belt will become loose and because of this it will take a few seconds before normal workload is obtained the first time the ergometer is used.

Electronic calibration - terminal

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Brake belt is loose*. If not, move the pendulum to 4 kp and hold it there for some seconds. Move the pendulum down to 0-position again, and check that the brake belt is loose.
2. Adjust the meter panel, see section "Zero adjustment of meter panel", so that the index line of the pendulum is opposite the 0-index of the scale, see *Fig: 0-position*.
3. Push alt. *5* in the main menu (calibration) and follow the instructions on the display. Hold the pendulum in 0-position and wait for a beep, see *Fig: 0 kp*. NOTE! The pendulum must remain stationary.
4. Move the pendulum to 2 kp and wait for a beep, move teh pendulum to 4 kp and wait for a beep. Finally move the pendulum to 6 kp and wait for two beeps shortly after each other. See *Fig: 2 kp, Fig: 4 kp, Fig: 6 kp* and *Fig: 0 kp*.
5. Lower the pendulum back to standby mode (0-index).

The calibration is done.

NOTE! The pendulum must remain stationary at the different positions.

Electronic calibration - PC

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Brake belt is loose*. If not, move the pendulum to 4 kp and hold it there for some seconds. Move the pendulum down to 0-position again, and check that the brake belt is loose.
2. Adjust the meter panel, see section "Zero adjustment of meter panel", so that the index line of the pendulum is opposite the 0-index of the scale, see *Fig: 0-position*.
3. Start the program "Monark 839E Analysis Software" in the computer.
4. In the menu "Monark 839E", choose "Check calibraton...".
5. Follow the instructions shown on the screen. See also *Fig: 2 kp, Fig: 4 kp, Fig: 6 kp* and *Fig: 0 kp*.

The calibration is done.

NOTE! The pendulum must remain stationary at the different positions.

Electronic calibration - with the pendulum

From software version R15

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Check loose brake belt.* If not, move the pendulum to 4 kp and hold it there for some seconds. Move the pendulum down to 0-position again, and check that the brake belt is loose.
2. Adjust the meter panel, see section "Zero adjustment of meter panel", so that the index line of the pendulum is opposite the 0-index of the scale, see *Fig: 0-position*.
3. Turn off the power (on the switch) and move the pendulum till 4 kp, see *Fig: 4 kp*.
4. Hold the pendulum at 4 kp and turn the power on the bike again and wait for beep. Lower the pendulum to 0, see *Fig: 0 kp*. Wait for a beep.
5. Move the pendulum to 2 kp, see *Fig: 2 kp*. Wait for a beep.
6. Move the pendulum to 4 kp, see *Fig: 4 kp*. Wait for a beep.
7. Move the pendulum to 6 kp, see *Fig: 6 kp*. Wait for two beeps. Lower the pendulum to 0 again.

The calibration is done.

NOTE! The pendulum must remain stationary at the different positions.

Fig: Check loose brake belt.

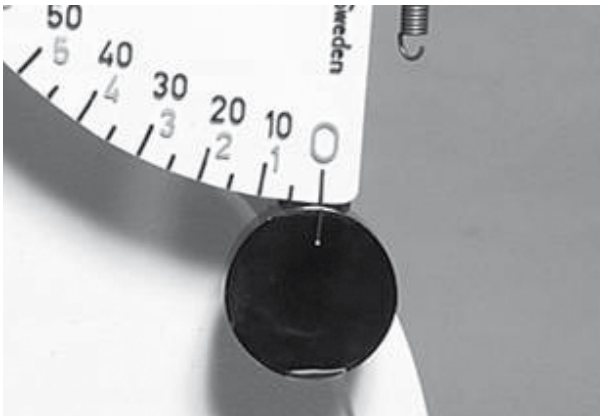


Fig: 0-position

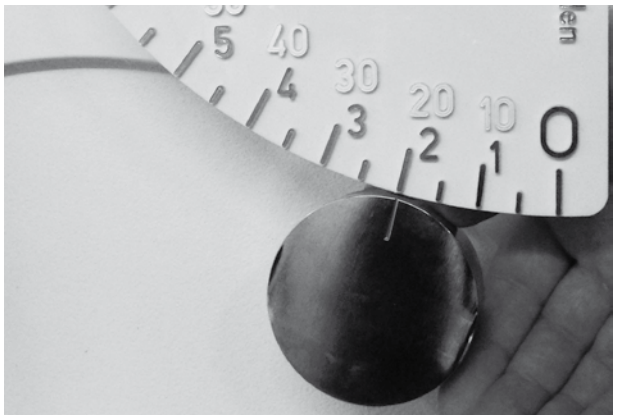


Fig: 2 kp

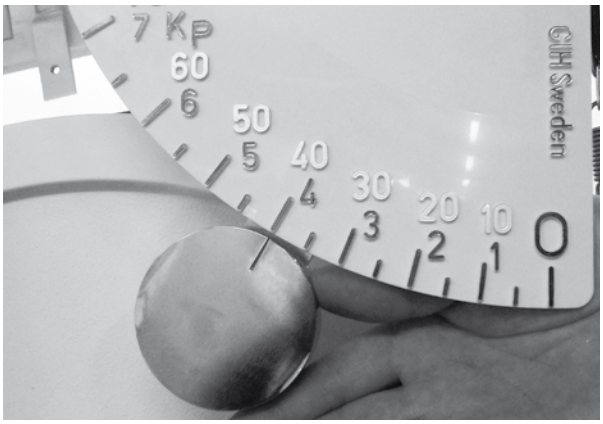


Fig: 4 kp

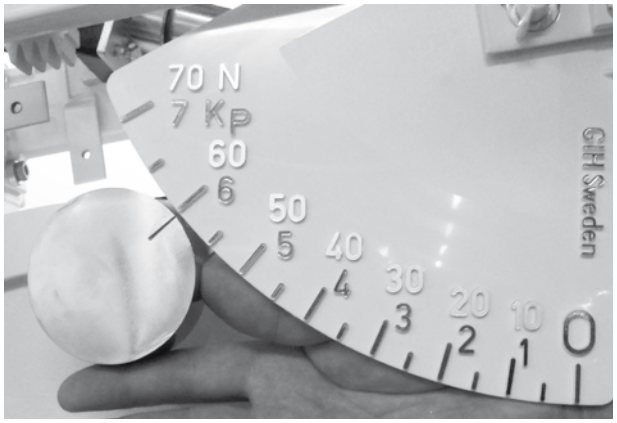


Fig: 6 kp

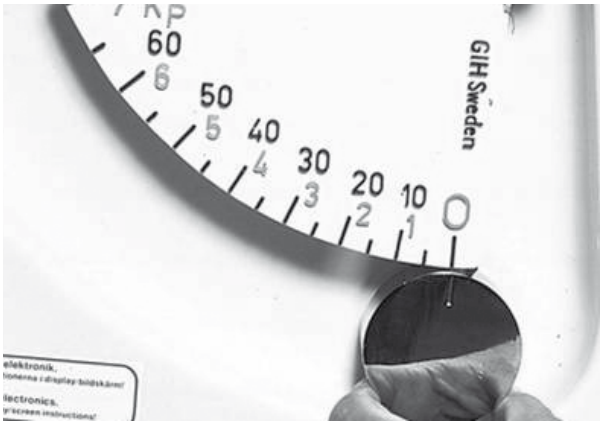


Fig: 0 kp

Calibration

The 831 E is a mechanically weighted and braked ergometer, making performance validation a simple procedure. The work performed on the ergometer is the product of the weight lifted times the numbers of revolutions (factored). Validation includes both mechanical and electronic procedures. If the ergometer fails to pass any section of the validation, proceed to the calibration and/or service menu ('99' in the main menu).

Inspection of all mechanical components is suggested after any repair, or component service. The following validation should be performed annually:

1. Remove the cover from the flywheel.
2. Loosen the brake belt at the balancing spring.
3. Wait until the flywheel is no longer moving.
4. The pendulum weight index should be aligned with "0" on the scale.
5. Connect the calibration weight to the point at which the spring was attached.
6. The known weight should match the value on the scale. If not see section "Calibration of Pendulum Weight ".
7. Reattach the brake belt.
8. Reassemble the cover.

Proceed to the validation to complete.

Validation

The following procedure will assure the user that the ergometer is performing properly on a daily basis. The test exercises the mechanical braking, rpm and speed detecting systems, as well as the computer regulation and sensing capability of the mechanical system.

Additionally, if a calibrated ECG simulator is available, it may be used to verify the heart rate measuring system. Whether the simulator is used or not, the heart rate system may be validated by simply taking a pulse point rate measurement at the neck for example. While a patient is at rest and has been prepared for chestbelt electrodes or an ear sensor, the pulse indicator flashes once per pulse beat. The displayed rate, should agree with the manually detected pulse rate. If not, check the patient electrode connection and skin preparation prior to requesting service.

Validation of force

From main menu go to any start display with Newtons (N).

1. With the pendulum at zero, the display should read "00N".
2. Move the pendulum weight to the 4 kp position and the display should read "39N".
3. Decrease the position of the weight by steps of 1 kp. The display should read correctly at all positions.

NOTE!
The brake belt will become loose and because of this it will take a few seconds before normal workload is obtained the first time the ergometer is used.

Electronic calibration

Calibration is necessary to match the mechanics of the ergometer to the electronics of the computer. The following steps are required to recalibrate the electronics to the pendulum scale.

1. Check at the bottom of the flywheel that the brake belt is loose. If not move the pendulum to 4 kp and hold it for a few seconds. Move the pendulum to the zero position again. Check that the brake belt is loose.
2. Align the force scale with zero marker on the pendulum. Refer to section ”Zero adjustment of meter panel” for details.
3. Press key ‘5’ in the main menu (Calibration) and follow the display instructions. Hold the pendulum at 0-position and wait for one beep.
4. Hold the pendulum at 2 kp-position and wait for one beep. Hold the pendulum at 4 kp-position and wait for one beep. Move the pendulum to the 6 kp position as told in the display. Hold it in position and wait for two beeps shortly after each other.
5. Lower the pendulum to the resting position (0-marking). Calibration is done.

The calibration coefficient which has been calculated by the computer is stored in the continuous memory. Whenever power is applied to the ergometer, the latest calibration value is restored to maintain memory. A new calibration replaces previous values.

Generally, it is not necessary to recalibrate the ergometer often. The coefficient is maintained even when power is removed and the physical orientation of the frame, within the limits of normal using, has no effect on the electrical calibration. Recalibration should be performed following any service, component replacement, or transport of the unit or after setting to default in the service menu (‘99’).

A daily validation of the pendulum force sensor should be performed. If the procedure reveals an error, recalibration may be necessary.

Check of the electronic calibration can be done as follows: From main menu go to any of the test windows showing Newtons (N). Move the pendulum to 4 kp (39N). This position shall now be read in the display. If not perform a new calibration.

NOTE!
After this check the brake belt will be loose, which means that the first time the ergometer is used after calibration it will take a few seconds before normal workload (5 N) is obtained.

Calibration of pendulum weight

Although all Ergometers are calibrated at the factory the user may wish to verify this by performing a mechanical scale calibration. If so, please do the following.

Remove the cover from the flywheel. Loosen the balancing spring from the brake belt. Check that the 0-index of the scale is in line with the index of the pendulum weight. Adjust if needed. Note: Wait until the flywheel is not moving any longer.

Connect a known weight, e.g. 4 kg (Art. No: 9000-221) where the balancing spring was placed. Note: The weight should not be lighter than 3 kg, due to the possibility of inferior accuracy.

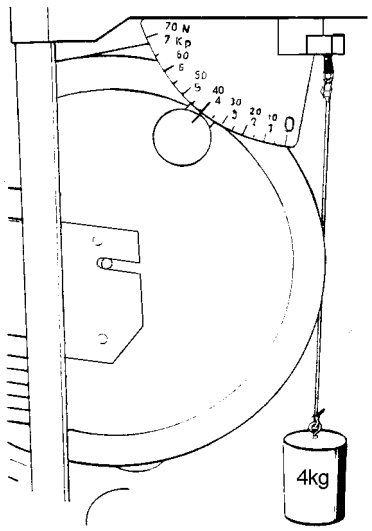
When correctly set, it should be possible to read this weight from the corresponding place on the meter panel.

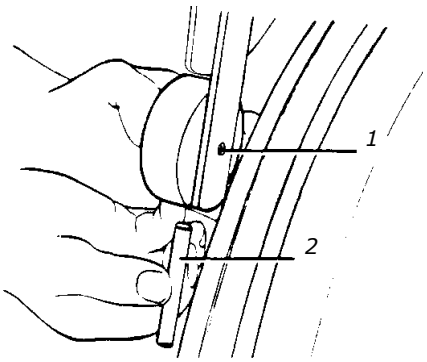
Should there be a deviation, adjust the pendulum to the correct position on the scale by means of the adjusting weight. In order to change the position of the adjusting weight, loosen the lock screw(1) of the weight.

Should the index of pendulum weight be too low, move the adjusting weight(2) upwards into the weight. Should the index be too high the adjusting weight is moved downwards and locked in the new position. This procedure is repeated until the correct reading is achieved.

Check the calibration of the pendulum weight once a year or when needed.

Assemble the front cover again.





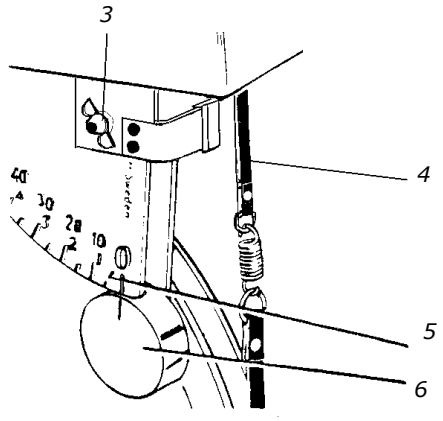


Fig: Calibration
1) Lock screw
2) Adjusting weight
3) Lock nut
4) Brake belt
5) Meter panel
6) Weight

Zero adjustment of meter panel

Move the pendulum to 4 kp and keep it there for a few seconds. Check that the belt is loosened. If adjustment is necessary, loosen first the lock nut(3) and then change the position of the meter panel(5), so that the board will have its 0-index in line with the index of the weight. Tighten the lock nut after the adjustment.

Testing with Ergomedic 831 E

The versatility of the 831 E Ergometer enables it to be utilized in a variety of testing environments. The precision and reproducibility of measurements made with the ergometer in conjunction with the ease of testing, allow it to be employed in clinical exercise stress facilities, corporate fitness programs and health clubs. The backgrounds of both the individuals being tested and those administering the test may be vastly different in these widely varying testing situations.

In general, whether in a clinical laboratory or a health club, the test subject may be exercised quite strenuously, depending on workloads which have been selected. As a precaution, it may be advisable, prior to beginning an exercise protocol, that each test subject consult with a physician. Before testing, the operator should review the entire protocol operation with the test subject, explaining the work which will be required and the duration of the procedure. A system of communicating fatigue, chest pain or other abnormal physical response to the exercise should be discussed.

The test subject should not engage in heavy physical activity for several hours prior to testing to establish maximum oxygen consumption. In addition, all testing and exercise protocols should be performed a reasonable time after meals. The test subject should also refrain from smoking within an hour of the testing period.

The test subject should be prepared for using the ergometer, including the selection of proper clothing which neither interferes with the physical activity nor endangers the health of the subject. The test subject may need some education concerning the cranking of the ergometer.

The operation of the speed metronome and over/under display should be reviewed. The maintenance of the proper speed should be practiced at a low workload.

Finally, the chestbelt should be applied and monitored to check for proper heart rate operation. The baseline heart rate may also be of assistance in determining the nervousness of the test subject. The test subject should exhibit a relatively stable resting heart rate prior to starting the protocol.

Power calculation

1 rpm = 6 m on the flywheel brake surface.

50 rpm = 300 m
2 kp force makes 2 x 300 = 600 kpm/min

100 rpm= 600 m
1 kp force makes 1 x 600 = 600 kpm/min

(watt = rpm x kp)

Further information regarding the submaximal tests on an armergometer is available on our website, www.monarkexercise.se. In the ”Sports & Medical” - ”Tests & Studies” - ”Protocols” you will find the document ”Upper-body fitness”.

Heart rate (Telemetry system)

The test subject's heart rate can be monitored by chestbelt telemetry system. The system with chestbelt electrodes is standard equipment.

The chestbelt should be secured at a comfortable tension around the mid section, just below the breast muscle. Moisten the electrodes before use. Heart rate monitoring, free from artifact, requires good electrode contacts and adequate skin preparation. Prior to placing the electrodes, the test subject's skin at the electrodes sites, should be cleaned with a commercial skin prep solution. To make sure that you have found the correct position the logo should have been placed in the center of chest and also be readable by another person. To enable a reliable contact with pulse receiver on the ergometer the distance should be kept below 100 cm. It is important to identify the chestbelt with the pulse receiver by standing close to it before beginning (max 60 cm, concerns Polar belts). After the chestbelt is placed the heart rate will be displayed and the heart symbol will verify each beat. If the rpm bar is set to show optical heart beat in the middle section this will also verify each heart beat.

NOTE! Electromagnetic waves can interfere with the telemetry system. Cellular phones are not allowed to be used near the ergometer during test.

If the ergometer is to be used without a chestbelt note that maximum heart rate alarm should be set in "off" position so that external noise cannot cause a random maximum pulse or higher. This switch is in "on" position by default. If the heart rate exceeds the maximum level set, the alarm will sound and the ergometer braking force will decrease until the heart rate drops below the alarm level.

Subject supervision

The ergometer performs automated tests virtually by itself, requiring minimal intervention by the operator. This allows the operator to pay careful attention to the test subject without distraction. The response to the exercise protocol can be accurately estimated and appropriate action to assist the test subject, if necessary, may be given. The user is subjected to considerable exercise in certain advanced protocol stages. The effect on the test subject should not be underestimated.

During the testing, the general appearance and heart rate may be the most crucial factors to monitor. The testing should be stopped immediately if the test subject reports chest pain, difficulty breathing, etc. A system of prompt medical attention should be set up prior to testing, in case of emergency.

The test subject may also show difficulty in regulating the speed of the ergometer. The power will be properly regulated regardless of the speed, assuming that the protocol work type is not force and that the speed is maintained above the rpm low setting (default is 30 rpm).

In addition, some test subjects may become sensitive to the display on the handheld remote controller. If this is suspected, the controller may be removed from its cradle and located out of view. Similarly, the pulse LED may disturb the test subject and may be disabled.

Reviewing results

The maximum oxygen uptake is the standard measurement of cardiopulmonary fitness. Dependent on the linear relationship between work and oxygen uptake and between work and heart rate, the heart rate response to work may be used to estimate the oxygen consumption. If the maximum heart rate is considered, the maximum oxygen consumption may be determined.

The YMCA and Åstrand protocols estimate the maximum oxygen consumption, based on a submaximal workload while all others report the oxygen consumption required by the final workload. The Bruce and Naughton protocols require that the test subject exercise at a workload level for a minimum of one minute to establish the oxygen consumption. If less than one minute is observed, the previous workload value is used.

The estimated maximum oxygen consumption derived from some of the ergometer tests is subject to the error of the "age related predicted maximum heart rate". Although there is a definite and linear relationship between work and oxygen uptake, there are some differences in actual oxygen uptake based on individual work efficiency. Persons who are less familiar with ergometer exercise and those individuals who are less fit, are more likely be less efficient than those who use ergometers frequently.

It should be noted that these results are estimates or predictions of maximal response and have a greater chance of being in error than if the individual were tested to their actual maximum value. Interpretation should therefore be made more carefully with an understanding of the possibility of errors in the methodology.

NOTE!
The Åstrand test is designed for leg ergometer. Therefore, these tables are not comparable straight off when the test is performed on an arm ergometer.

A relative fitness index can be obtained from the following tables:

Fitness Rating Index - Males Maximum Oxygen Consumption ml/kg/min				*Fitness Rating Index - Females Maximum Oxygen Consumption ml/kg/min*			
Rating				*Rating*			
	-36 yrs	*36-45 yrs*	*45- yrs*		*-36 yrs*	*36-45 yrs*	*45- yrs*
Excellent	*54*	*53*	*43*	*Excellent*	*55*	*49*	*46*
Good	*49*	*45*	*38*	*Good*	*45*	*43*	*38*
Above Average	*46*	*39*	*34*	*Above Average*	*39*	*37*	*32*
Average	*36*	*33*	*30*	*Average*	*34*	*33*	*27*
Below Average	*32*	*29*	*27*	*Below Average*	*30*	*29*	*24*
Fair	*28*	*25*	*24*	*Fair*	*26*	*26*	*20*
Poor	*24*	*23*	*20*	*Poor*	*20*	*22*	*18*

See also table 7 in " Work tests with the Bicycle Ergometer" by P O Åstrand.

Operation interferences

It is normally considered that about 70 % of all shutdowns on small computers are caused by mains interferences, i.e. at shot over voltage. These interferences can often be caused by different machinery, which is started or stopped. The processor in the computer is then reacting incorrectly or is not working at all. The problems can be solved by means of a mains interference protector, which is connected between the mains and the transformer.

Troubleshooting guide

Symptom	Probable Cause/Corrective Action
LED doesn't light up.	No current in the outlet. Check the fuses. Right trafo? Check so that the trafo information in section "Facts" is in accordance with the trafo used.
No connection to PC.	Check cables. Right COM port? Drivers missing when using the USB serial adaptor. CD with drivers is included. Is the right "type cmd" set?
Does not load work.	Check rpm (no force is applied if rpm is less than the pedal low ref, default 30 rpm). Check calibration.
No heart rate.	Check the chestbelt (battery). Wet the thumbs and place them on the electrodes. A low clicking sound will appear near battery lid while you click on the electrodes with one thumb. Use another external HR monitor to check the belt. Check that the chestbelt is positioned correctly on test subject and tight enough. Check that the electrodes are wet, in some cases it is necessary to use a contact gel or a mixture of water with a few drops of washing-up liquid. The level for HR signal can vary from person to person. Put chestbelt on another known person who has a good pulse rendering. Check for no loose cables or jack if you have a plug-in receiver. Use another pulse receiver (pulse watch or test bike monitor) to check the chestbelt. Check that it is the correct receiver and that it is in the correct place. If it has a round Polar-sticker it should be placed straight.
No rpm reading.	Check cable.
Unable to calibrate force.	Potentiometer belt may be slipping or broken. Replace if damaged. Potentiometer misadjusted. Reboot memory from service menu (99). Set default (3).
Uneven heart rate.	Use an external unit, for example a pulse watch, to check if it also indicates irregular pulse. If his is the case, there is probably disturbance in the room. Magnetic fields from high voltage cables, elevators, fluorescent tube etc can cause the disturbance. Other electronic equipment could be placed too close. If irregular pulse remains we recommend measuring HR manually. If HR still remains irregular at workload test subject's health needs to be examined.
There is a click noise with every pedal revolution (increases with the weight).	The pedals are not tight. Tighten them or change pedals. The crank is loose. Check, tighten. The base bearing is loose. Contact your dealer for service.
Scratching sound is heard when pedalling.	Check that the carriage block is taken off and that none of the covers is scratching.
There is a click noise and a squeak noise when pedalling.	Loosen the chain.

Message	Reason
Test Aborted	*An automatic protocol operation has been stopped too early. No results are available.*

Where to obtain additional information

The user may require more information concerning several areas of the ergometer usage. This manual was intended to instruct the reader primarily in the operation of the ergometer. References are made to related topics in the discussions concerning the testing procedures and the protocol operation sections. The following literature may provide some greater insight to ergometer-based testing, without confusing the reader with technical medical terms. Both texts were written specifically to provide basic understanding of the testing methodology and results. Attention is paid to details concerning programme set-up and management.

- Åstrand, P-O, ”Work Tests with the Bicycle Ergometer”, Monark AB, Varberg, Sweden.
- Golding LA, Myers CR, Sinning WE, ”Y´s way to physical fitness”, YMCA of the USA, Rosemont, IL 1982.

For more technical details, see the section entitled “Reference“.

References

1. Åstrand I, ”Aerobic work capacity in men and women with special reference to age”, Acta Physiol Scand. 49 (suppl. 169), 1960.
2. Åstrand P-O, ”Experimental studies of physical working capacity in relation to sex and age”, Munksgaard, Köpenhamn, 1952.
3. Åstrand P-O, Rodahl K, ”Textbook of Work Physiology”, McGraw-Hill, New York, 1970.
4. Bruce RA, Kusumi F, Hosmer D, ”Maximal oxygen intake and nomographic assessment of functional aerobic impairment in cardiovascular disease”, Am Heart J 85:546-562,1973.
5. Naughton J, ”Exercise Testing and Exercise Training in Coronary Heart Disease”, Academic Press, New York, 1973.
6. Golding LA. Myers CR, Sinning WE, ”Y´s way to physical fitness” YMCA of the USA, Rosemont, IL, 1982.
7. Wilson PK, Bell CW, Norton AC, ”Rehabilitation of the heart and lungs”, Beckman instruments, 1980.
8. Åstrand P-O, “Work Tests with the Bicycle Ergometer“, Monark AB, Varberg, Sweden.

Service

Warning

Make sure the voltage indicated on the appliance corresponds to the local mains voltage before making connections.

Warranty

EU countries - Private use
If you are a consumer living in the EU you will have a minimum level of protection against defects in accordance with EC Directive 1999/44/EC. In short, the directive states for that your Monark Dealer will be liable for any defects, which existed at the time of delivery. In case of defects, you will be entitled to have the defect remedied within a reasonable time, free of charge, by repair or replacement.

EU countries - Professional use
Monark Exercise products and parts are guaranteed against defects in materials and workmanship for a period of one year from the initial date of purchase of the unit. In the event of a defect in material or workmanship during that period, Monark Exercise will repair or replace the product. Monark Exercise will not, however, refund costs for labour or shipping.

Other countries
Monark Exercise products and parts are guaranteed against defects in materials and workmanship for a period of one year from the initial date of purchase of the unit. In the event of a defect in material or workmanship during that period above, Monark Exercise will repair or replace (at its option) the product. Monark Exercise will as above for labour or shipping.

Service check & maintenance

It is important to carry out a regular service on your ergometer, to ensure it is kept in good condition.

Service action:

- We recommend isopropyl alcohol to disinfect the surface of the bike. Use a damp, but not wet cloth to clean the surface you wish to disinfect.
- Clean and lubricate your Ergometer weekly.
- Periodically wipe the surface with a rust preventative, especially when it has been cleaned and the surface is dry. This is done to protect the chrome and zinc parts as well as the painted parts (4 times per year).
- Check that pedals are firmly tightened. If not, the threading in the pedal arms will be damaged. Also check that the pedal arms are firmly tightened on the crank axle, tighten if necessary. When the Ergometer is new it is important to tighten the pedals after 5 hours of pedalling (4 times per year).
- Check that the pedal crank is secure to the crank axle (4 times per year).
- Be sure that the pedals are moving smoothly, and that the pedal axle is clear of dirt and fibres (4 times per year).
- When cleaning and lubricating be sure to check that all screws and nuts are properly tightened (twice a year).
- Check that the chain is snug and there is no play in the pedal crank (twice a year).
- Check that pedals, chain and freewheel sprocket are lubricated (2 times per year).
- Be sure that the brake belt does not show significant signs of wear (twice a year).
- Check that the handlebars and seat adjustment screws are lubricated (twice a year).
- Be sure that all moving parts, crank and flywheel are working normal and that no abnormal play or sound excsists. I.e. play in bearings causes fast wearing and with that follows a highly reduced lifetime.
- Check that the flywheel is placed in the center and with plane rotation.

Batteries

If the meter is battery-operated, the batteries are in a separate package at delivery. If the storing time has been long the battery power can be too low to make the computer act correctly. Batteries must be changed.

Crank bearing

The crank bearing is greased and normally requires no supplementary lubrication. If a problem arises, please contact your Monark dealer.

Flywheel bearing

The bearings in the flywheel are greased and do not normally require maintenance. If a problem arises, please contact your Monark dealer.

Transport

At transport the brake belt should be tightened to prevent it from falling off the flywheel.

Replacement of brake belt

To replace the brake belt remove covers if necessary. Make sure that the belt is loose.

Alt. 1: To loosen the belt on pendulum bikes with a motor, turn the power on and move the pendulum to 4 kp. Hold it there until the brake belt is loose. Observe how the belt is connected. Take it apart and remove it from the bike. Attach the new brake belt and assemble the bike in reverse order.

Alt. 2: To loosen the brake cord on cycles with a weight basket set the basket to its upper position. Loosen the lock washer that is holding the cord and remove it from the tension center. Loosen or cut off the knot on the other end of the cord and then remove the whole cord from the bike. When assembling a new brake cord, first enter one end into the hole in the tension center, tie a knot and let the knot fall into the bigger part of the hole. Lock the end of the cord with the lock washer.

Alt. 3: To loosen the belt on other bikes remove all possible tension. Observe how the belt is connected. Take it apart and remove it from the bike. Attach the new brake belt and assemble the bike in reverse order.

NOTE: When replacing the brake belt it is recommended to clean the brake surface. See ”Brake belt contact surface”.

Brake belt contact surface

Deposits of dirt on the brake belt and on the contact surface may cause the unit to operate unevenly and will also wear down the brake belt. The contact surface of the flywheel should be smoothed with fine sandpaper and any dust removed with a clean dry cloth.

Remove any covers and loosen the tension on the brake belt. Smoothe with fine sandpaper. This is easier to perform if a second individual cautiously and carefully pedals the cycle.

Irregularities on the brake belt contact surface are removed by means of a fine sandpaper or an abrasive cloth. Otherwise unnecessary wear on the brake belt may occur and the unit can become noisy.

Always keep the brake belt contact surface clean and dry. No lubricant should be used. We recommend replacing the brake belt when cleaning the contact surface. In regard to assembly and adjustment of the brake belt, see ”Replacement of brake belt”.

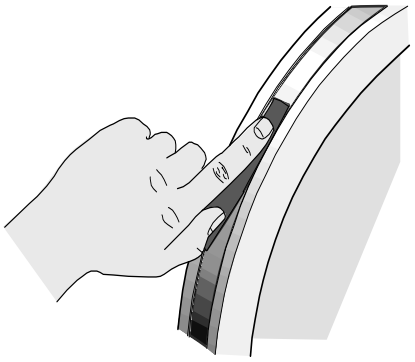


Fig: Brake belt contact surface

Chain 1/2" x 1/8"

It is strongly recommended to keep the chain clean. Dirt build-up on the chain will cause excess wear. A chain lubricant and solvent for normal road bikes may be used.

Check the lubrication and tension of the chain at regular intervals. In the middle of its free length the chain should have a minimum play(3) of 10 mm (1/4 inch). See *fig: Chain adjustments*. When the play in the chain is about 20 mm (3/4 inch) it must be tightened otherwise it will cause abnormal wear of the chain and chainwheels. Because of this it is always recommended to keep the chain play as little as possible. Loosen the hub nut(2) on both sides and tense the chain with the chain adjuster(1) when needed.

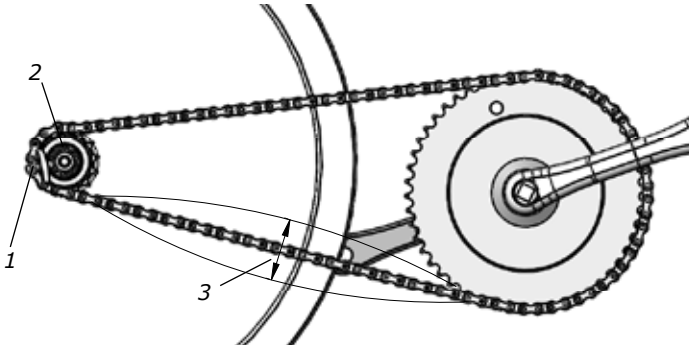


Fig: Chain adjustments
1) Chain adjuster
2) Hub nut
3) Chain play

When the chain has become so long that it can no longer be tightened with the chain adjusters it is worn out and should be replaced with a new one.

To adjust or replace the chain remove frame covers if necessary.

To adjust the chain the hub nuts(2) should be loosened. Loosening or tightening the nuts on the chain adjusters(1) will then move the hub and axle forward or backward. Adjust according to above recommendation. Then tighten the nuts on the hub axle again. See *fig: Chain adjustments*.

To replace the chain, loosen the chain adjuster as much as possible. Dismantle the chain lock(6) and remove the chain. Put on a new chain and assemble the chain lock. The spring of the chain lock should be assembled with the closed end in the movement direction(5) of the chain. Use a pair of tongs for dismantling and assembling the spring(4). See *fig: Chain replacement*.

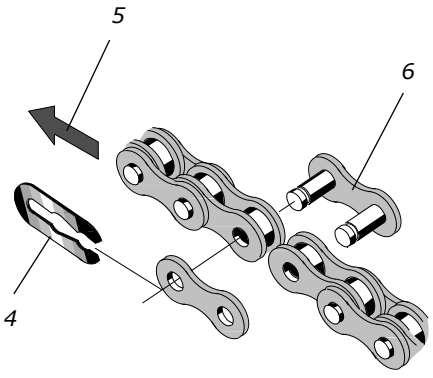


Fig: Chain replacement
4) Lock spring
5) Movement direction
6) Chain lock

NOTE: At assembly, the flywheel has to be parallel with the centerline of the frame otherwise the chain and chain wheels make a lot of noise and wear out rapidly.

Adjust chain adjusters to allow chain play according to above. Tighten hub nuts firmly. Replace frame covers.

Freewheel sprocket

When replacing the freewheel sprocket remove frame covers if necessary. Dismantle the chain as described in part ”Chain 1/2” x 1/8” ”.

Loosen the axle nuts and lift off the flywheel. Remove the axle nut, washer, chain adjuster and spacer on the freewheel side. Place the special remover (Art. No: 9100-14) in the adaptor and place the spacer and axle nut outside. See *fig: Special remover.* Replace sprocket-adaptor and assemble the new parts in reverse order according to the above.

NOTE: Do not tighten the axle nut completely. It must be possible to loosen the adaptor-sprocket half a turn.

The sprocket should be lubricated with a few drops of oil once a year. Tilt the cycle to make it easier for the oil to reach the bearing. See *fig: Lubrication.*

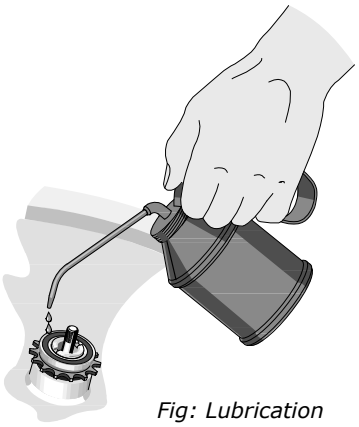


Fig: Lubrication

Fig: Special remover (Art. No: 9100-14)

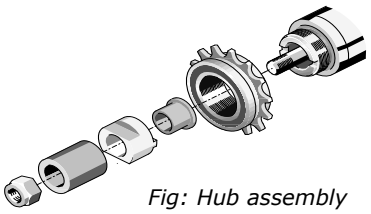
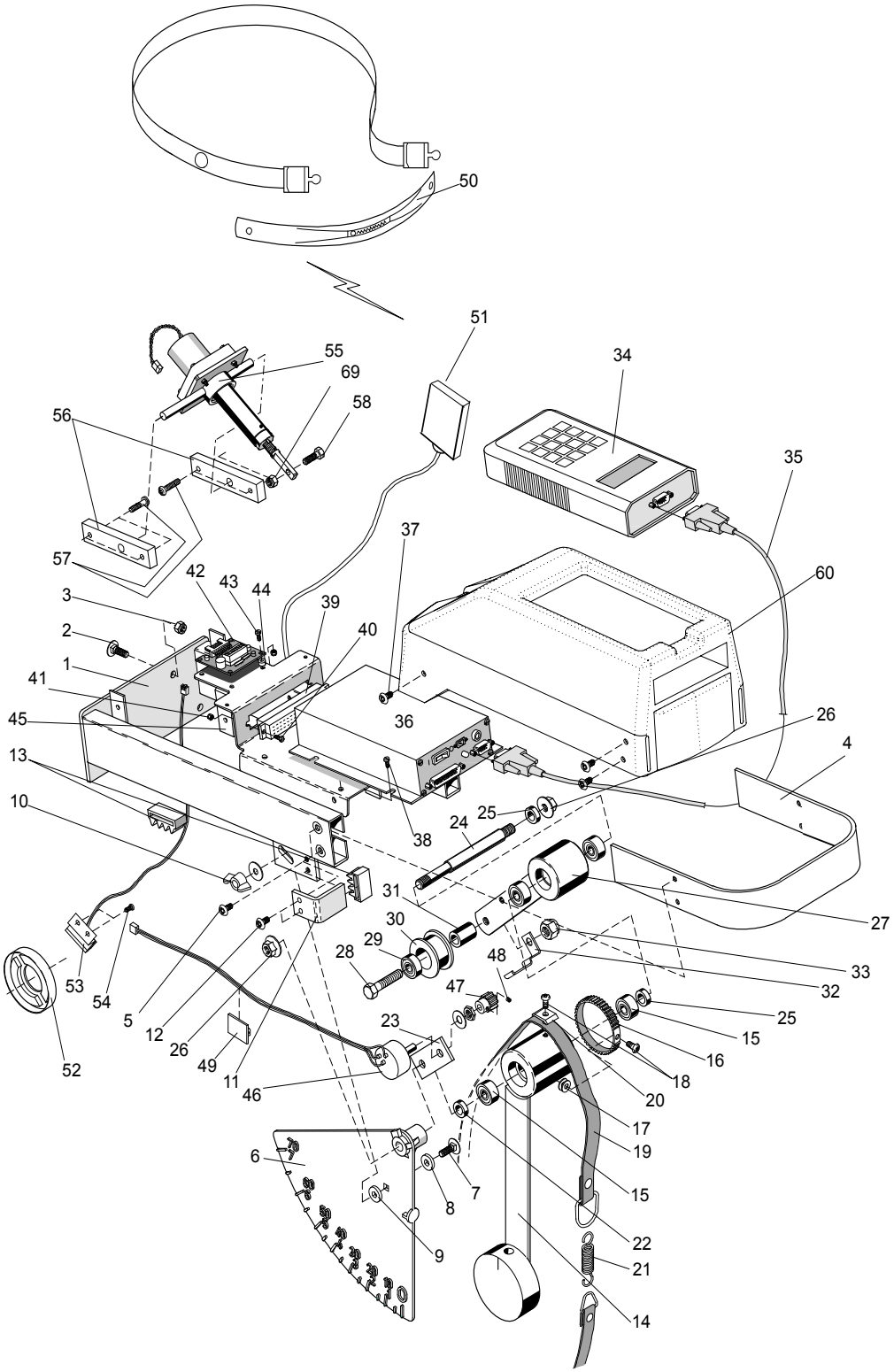


Fig: Hub assembly

Spare parts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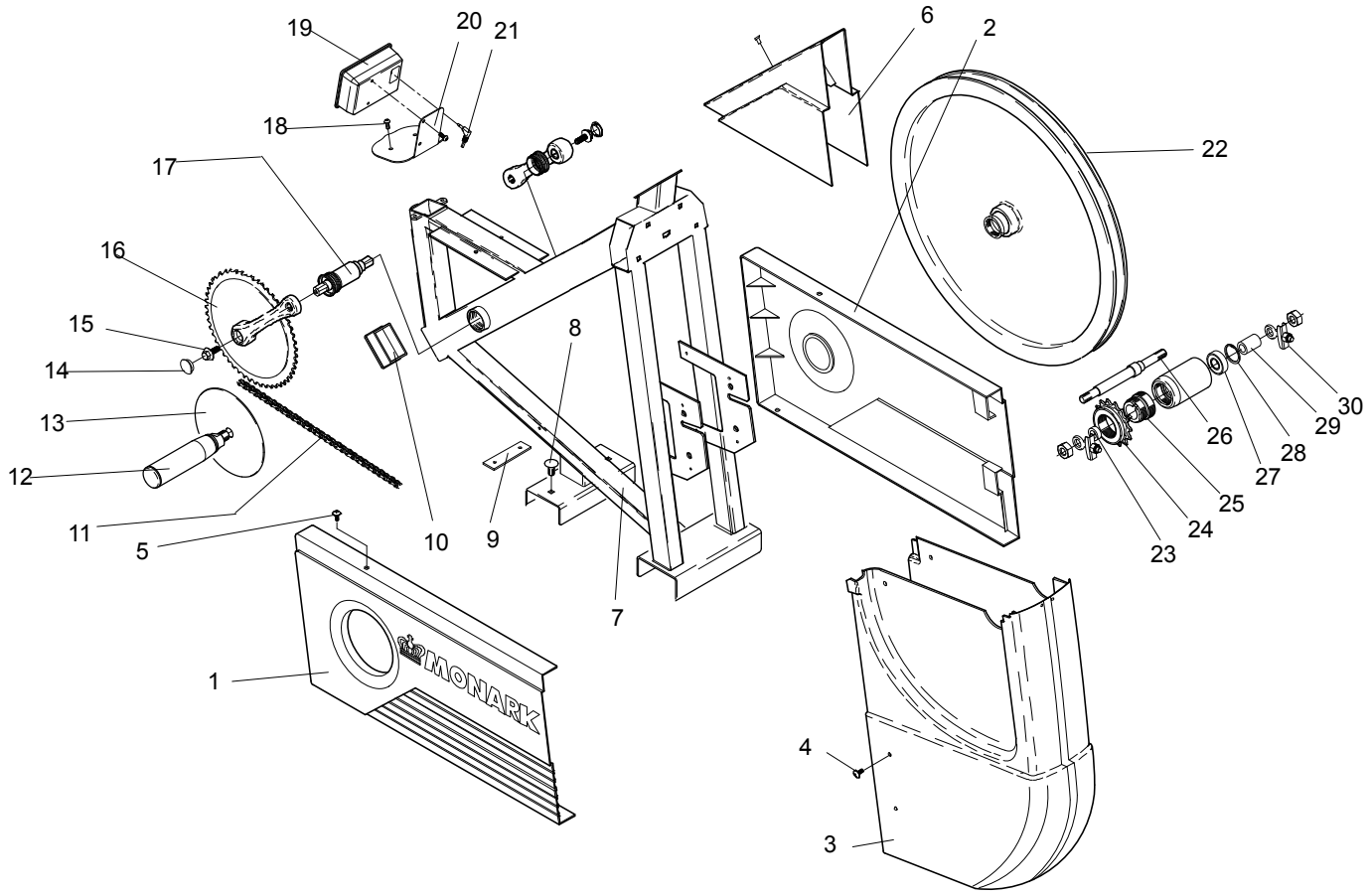
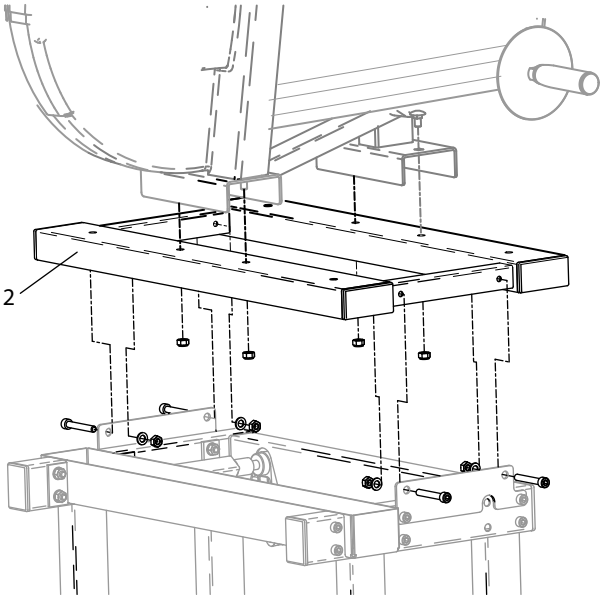
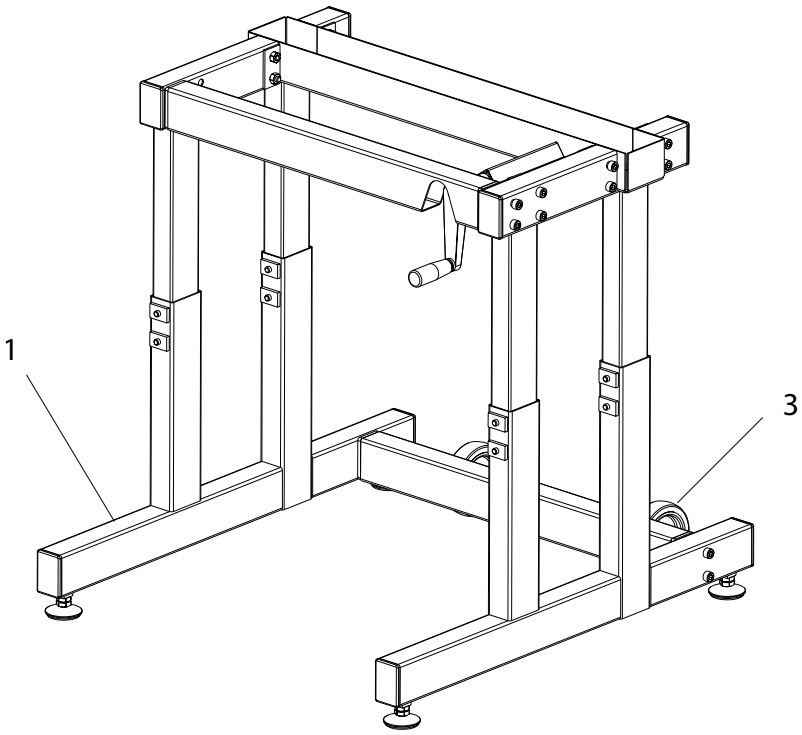
Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No:	Description
1	1	9339-38	Frame for equipment	31	1	9339-32	Spacer
2	4	9300-21	Screw MVBF 6x16 mm	32	1	9339-23	Belt control
3	4	5843-9	Nut M6	33	1	5844	Nut M8
4	1	9339-59	Handle	34	1	9339-51	Handheld controller
5	4	5673-9	Screw M5	35	1	9339-27	Communication cable, 1.8 m
6	1	9339-100	Meter panel	36	1	9339-52	Base unit
7	1	9339-21	Screw M6	37	6	5673-9	Screw M5x12
8	1	5880	Washer	38	4	5675-9	Screw M5x6,5
9	1	5862	Washer	39	1	9339-25	Connection device
10	1	9000-102	Wing nut M6	40	2	9305-42	Screw MCS M3x30 fzb
11	1	9300-94	Stop	41	2	5840	Nut M3
12	2	5671-9	Screw M5	42	1	9339-56	Card for metronome
13	2	9300-99	Plastic stop	43	4	9339-49	Screw MCS M3x10 fzb
14	1	9300-88	Weight lever with bearing	44	4	9339-33	Spacer
15	2	19001-6	Bearing 6001-2z	45	1	9339-24	Cover
16	1	9303-54	Belt 55T	46	1	9339-62	Potentiometer
17	2	5861	Washer	47	1	9303-52	Pulley
18	1	5673-9	Screw M5	48	1	9305-44	Screw
19	1	9339-61	Brake belt	49	1	9300-66	Holder
20	1	9300-92	Bracket	50	1	9339-98	Chestbelt DT
21	1	9008-124	Spring	51	1	9339-76	Receiver DT
22	1	9339-87	Spacer	52	1	9300-671	Dust cover with magnet
23	1	9303-51	Holder for potentiometer	53	1	9300-65	Crank sensor
24	1	9339-86	Axle	54	2	9326-59	Screw RXK B8x6.5 fzb
25	2	9000-17	Spacer	55	1	9339-57	Tension device, complete
26	2	5799	Nut	56	2	9339-40	Bracket for tension device
27	1	9339-22	Tension lever	57	4	5671-19	Screw M5
28	1	14359	Screw M8	58	1	14324-9	Screw M6
29	1	19088-6	Bearing	59	1	5843-9	Nut M6
30	1	9100-21	Tension cylinder	60	1	9339-80	Instrument cover



Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No:	Description
1	**1**	**9300-50**	**Chain guard**	**19**	**1**	**9391-70**	**Digital meter**
2	**1**	**9300-52**	**Side guard**	**20**	**1**	**9391-26**	**Meter holder**
3	**1**	**9339-55**	**Wheel cover**	**21**	**1**	**9326-263**	**Cable**
4	**2**	**9304-32**	**Screw M5x25 mm**	**22**	**1**	**9391-3**	**Flywheel with sprocket**
5	**2**	**5675-9**	**Mounting screw LKT-TT 5x6.5 mm**	**23**	**1**	**9000-17**	-Spacer 5 mm
6	**1**	**9300-57**	**Cover for frame**	**24**	**1**	**9106-13**	-Sprocket 14t
7	**1**	**9391-1**	**Frame**	**25**	**1**	**9106-14**	-Connection
8	**2**	**9300-12**	**Screw MVBF M8x16 mm**	**26**	**1**	**9300-18**	-Axle, length 132 mm
9	**1**	**9300-53**	**Holder for guard**	**27**	**2**	**19001-6**	-Bearing 6001-2z
10	**1**	**9391-55**	**Plastic cap**	**28**	**1**	**9000-15**	-Locking ring SgH 028
11	**1**	**9300-55**	**Chain 1/2" x 1/8", 116 l**	**29**	**1**	**9300-17**	-Spacer 23 mm
12	**1**	**9145-71**	**Handle, pair**	**30**	**1**	**9000-12**	-Chain adjuster, pair
13	**2**	**9371-71**	**Hand cover**		**1**	**9339-67**	**Power adaptor (18V, 240W)**
14	**2**	**8523-2**	**Dust cover**		**1**	**9339-66**	**Power adaptor (24V, 110-240W)**
15	**2**	**8523-115**	**Screw**		**1**	**9339-850**	**Chestbelt Polar T34**
16	**1**	**9300-430**	**Crank set, complete**		**1**	**9339-851**	**Strap for chestbelt Polar**
17	**1**	**8966-175**	**BB cartridge bearing, complete**		**1**	**9338-21**	**Receiver Polar**
18	**4**	**5673-9**	**Screw**		**1**	**9338-20**	**USB-serial adaptor**
					1	**9000-211**	**Calibration weight, 4 kg**





Pos.	Qty.	Art. No:	Description	Pos.	Qty.	Art. No:	Description
1	1	9391-80	Table stand, complete, height-adjustable	3	2	9000-29	Transport wheel, complete
2	1	9391-9	Upper part		1	9391-8-10	Screw set

MONARK EXERCISE AB

Version 1010
Art. No: 7950-298

CE 0402

KROONS VÄG 1, SE-780 50 VANSBRO, SWEDEN | WWW.MONARKEXERCISE.SE | TEL: +46(0)281 59 49 40 | FAX: +46(0)281 719 81